

REMARKS/ARGUMENTS

Favorable reconsideration of this application in light of the following discussion is respectfully requested.

Claims 1-31 are currently pending. The present Amendment amends Claims 1, 2, 5, 7, 9, 10, and 13-16 and adds Claims 18-31.

In the outstanding Office Action, Claims 1-3 and 10-15 were rejected under 35 U.S.C. 102(b) as being anticipated by Crouch et al. (International Publication Number WO 99/00297); Claims 1, 2, 6, 7-13, and 17 were rejected under 35 U.S.C. 102(b) as being anticipated by Lessen (U.S. Patent No. 3,881,669); Claims 1-4 and 10-15 were rejected under 35 U.S.C. 102(e) as being anticipated by Huenecke (U.S. Patent No. 6,513,761); and Claims 5 and 16 were rejected under 35 U.S.C. 103(a) as being unpatentable over the Crouch patent or the Huenecke patent in view of Tangler (U.S. Patent No. 4,406,336).

In order to clarify Applicant's invention, Claims 1 and 10 are amended to recite that the periodic perturbation has a wavelength capable of exciting at least one *internal* instability mode of the *core* of the first eddy. This feature finds non-limiting support in the disclosure as originally filed, for example at page 4, lines 16-25. In order to vary the scope of protection recited in the claims, new Claims 18-31 are added. New Claims 18-31 find non-limiting support in the disclosure as originally filed, for example in Applicant's specification at page 5, lines 20-25; page 10, lines 17-25; page 11, lines 1-3; page 13, lines 9-12; and in the original claims of allowed parent Application Serial No. 10/080,407. Therefore, the changes to the claims are not believed to raise a question of new matter.¹

In response to the rejection of Claims 1-3 and 10-15, Applicant respectfully requests reconsideration of the rejection, in light of the above amendments, as discussed below.

¹ See MPEP 2163.06 stating that "information contained in any one of the specification, claims or drawings of the application as filed may be added to any other part of the application without introducing new matter."

Briefly recapitulating, Applicant's invention, as recited in Claim 1, relates to a method for accelerating a destruction of a vortex formed at a rear of a wing of an aircraft by a merging of first and second co-rotating eddies, the method including: generating a periodic perturbation adjacent an area of creation of the first eddy, the periodic perturbation having a wavelength capable of exciting at least one *internal* instability mode of a *core* of the first eddy. Applicant's invention, as recited in Claim 10, relates to a method for accelerating a destruction of first and second contra-rotating vortices formed at a rear of first and second wings of an aircraft, the first contra-rotating vortex being formed by a merging of first and second co-rotating eddies, and the second contra-rotating vortex being formed by a merging of third and fourth co-rotating eddies, the method including: generating a first periodic perturbation adjacent an area of creation of the first eddy, the first periodic perturbation having a first wavelength capable of exciting at least one *internal* instability mode of a *core* of the first eddy; and generating a second periodic perturbation adjacent an area of creation of the third eddy, the second periodic perturbation having a second wavelength capable of exciting at least one *internal* instability mode of a *core* of the second eddy.

The Office Action asserts that the Crouch et al. publication, directed to an active control method and apparatus for encouraging the early destruction of trailing vortices, discloses every aspect and limitation of Claims 1-3 and 10-15. Applicant respectfully disagrees.

The Crouch et al. publication teaches a method and apparatus whose deficiencies, specifically noted in Applicant's specification, are corrected by the claimed invention. Specifically, the Crouch et al. publication "is based on the active excitation of the multiple instabilities of eddies by the movable surfaces of the aircraft, but without changing the

internal structure of the eddies, and without exciting an internal instability of the cores of these eddies.”²

Applicant respectfully submits that the Crouch et al. publication fails to teach “generating a periodic perturbation adjacent an area of creation of the first eddy, the periodic perturbation having a wavelength capable of exciting at least one *internal* instability mode of the *core* of the first eddy,” as recited in amended independent Claim 1 (and similarly recited in amended independent Claim 10). On the contrary, the Crouch et al. publication explicitly teaches “the direct excitation of one or more of the Transient Growth Mechanism, the Short Wavelength Instability, and the Long Wavelength Instability, to result in the accelerated breakup of the trailing vortices.”³ Of these instability modes, none are internal and none pertain to the core of the eddies.

In fact, Figs. 4A-4B of the Crouch et al. publication, which display distorted vortex pairs after amplification of an initial disturbance using the Long Wavelength Instability, the Transient Growth Mechanism, and the Short Wavelength Instability, respectively, clearly show that the core of the vortices remains intact in all cases; only the external topological arrangements of the vortices are changed. In particular, the core diameters are the same. Specifically, a translation occurs in Fig. 4A and different oscillations in space occur in Figs. 4B and 4C. Furthermore, even the simulations obtained by direct numerical solutions of the Navier-Stokes equations, which govern the dynamics of the vortices, for the Transient Growth Mechanism in Figs. 8B and 8C of the Crouch et al. publication show that the results are simply disturbances in the spatial arrangement of the vortices and are not concerned with internal instabilities of the core of the eddies.

² See Applicant's specification at page 3, lines 18-21.

³ See the Crouch et al. publication at page 4, line 33 – page 5, line 1.

Applicant respectfully submits that the Crouch et al. publication uses a completely different method from the present invention. In particular, the Crouch et al. publication is not concerned at all with the core of the eddies and all the features of Applicant's invention based on the vortex core, such as, e.g., "the first and second periodic perturbations are generated such that the diameters of the first and second vortices are greater than about 30% of the distance between the first and second vortices," as recited in Claim 12, which does not fit within the context of the Crouch et al. publication.

Therefore, the prior art fails to teach or suggest every feature recited in Applicant's claims, so that Claims 1-3 and 10-15 are patentably distinct over the prior art. Accordingly, in light of the above amendments and discussions, Applicant respectfully requests reconsideration of the rejection based on the Crouch et al. publication.⁴

In response to the rejection of Claims 1, 2, 6, 7-13, and 17, Applicant respectfully requests reconsideration of the rejection and traverses the rejection as discussed below.

The Office Action asserts that the Lessen patent, directed to a method and apparatus for eliminating or substantially attenuating the vortices which typically trail the airfoils of heavier-than-air aircrafts in flight, discloses every aspect and limitation of Claims 1, 2, 6, 7-13, and 17. Applicant respectfully disagrees.

Applicant respectfully submits that the Lessen patent fails to teach "generating a *periodic* perturbation adjacent an area of creation of the first eddy, the periodic perturbation *having a wavelength* capable of exciting at least one internal instability mode," as recited in independent Claim 1 (which is also representative of Claim 10).

⁴ See MPEP 2131: "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference," (Citations omitted) (emphasis added). See also MPEP 2143.03: "All words in a claim must be considered in judging the patentability of that claim against the prior art."

The Lessen patent states that “[i]t is these disturbances which, in the state of hydrodynamic instability created by the injection of a fluid stream pursuant to the practice of this invention, grow with respect to time and/or space to dissipate the trailing vortex.”⁵ The Lessen patent further states that “[t]he energy from the combined axial and swirling flow will be transformed to disturbance energy which will cause the directed flow energy to dissipate in turbulence”⁶ and “[t]herefore, the source of injected fluid must be provided with means for supplying the injected fluid at a flow rate which is adequate for the range of anticipated operating conditions.”⁷ Accordingly, the Lessen patent does not teach “a *periodic* perturbation,” but rather a continuous flow (at the prescribed flow rate). Moreover, the Lessen patent does not teach any kind of perturbation “having a wavelength” and does not teach or suggest a wavelength-based instability.

Further, Applicant respectfully submits that the Lessen patent fails to teach “emitting a jet of fluid *transverse* to a direction of travel of the aircraft,” as recited in independent Claim 7.

The Lessen patent states that “the method of the invention consists of injecting a fluid into the core of the trailing vortex consistent with certain *critical* criteria. Thus it is *essential* to the successful practice of the method of this invention (1) that the axis of the injected fluid stream be *colinear* and *coaxial* with the axis of the trailing vortex.”⁸ Therefore, since the axis of the injected fluid must be colinear and coaxial with that of the trailing vortex, the Lessen patent cannot teach “a jet of fluid *transverse* to a direction of travel of the aircraft” since the direction of travel of the aircraft, as illustrated in either Fig. 1 of the Lessen patent or Fig. 1 of Applicant’s specification, is colinear with that of the trailing vortex. In fact, as

⁵ See the Lesser patent at column 2, lines 18-25. Emphasis added.

⁶ See the Lesser patent at column 4, lines 18-21.

⁷ See the Lesser patent at column 4, lines 29-33.

⁸ See the Lesser patent at column 1, lines 31-36. Emphasis added.

cited above, Lessen's own words limit the scope of its method to the opposite of anything "transverse."

Therefore, the prior art fails to teach or suggest every feature recited in Applicant's claims, so that Claims 1, 2, 6, 7-13, and 17 are patentably distinct over the prior art. Accordingly, Applicant respectfully traverses, and requests reconsideration of, the rejection based on the Lessen publication.

In response to the rejection of Claims 1-4 and 10-15, Applicant respectfully requests reconsideration of the rejection and traverses the rejection as discussed below.

The Office Action asserts that the Huenecke patent, directed to an auxiliary counteracting vortex generating flap, discloses every aspect and limitation of Claims 1-4 and 10-15. Applicant respectfully disagrees.

Initially, Applicant notes that the Huenecke patent, like the Crouch et al. publication, is based on the active excitation of the multiple instabilities of eddies by the movable surfaces of the aircraft, but without changing the internal structure of the eddies, and without exciting an internal instability of the cores of these eddies. Applicant respectfully submits that the Huenecke patent does not teach a "periodic perturbation having a wavelength capable of exciting at least one *internal* instability mode of a *core* of the first eddy," as recited in Claim 1.

Moreover, the Huenecke patent teaches a controllable vortex generator positioned so that "the counteracting vortex causes a respective trailing vortex to vibrate, thereby dissipating the respective trailing vortex at least partially."⁹ The Huenecke patent further states that "[b]y rapidly dissipating the trailing vortices, the invention reduces or even avoids the formation of dangerous vortices downstream of the aircraft."¹⁰ Applicant respectfully

⁹ See the Huenecke patent at column 2, lines 53-56.

¹⁰ See the Huenecke patent at column 3, lines 12-15. Emphasis added.

submits that such a method thus precludes the actual formation of a “vortex formed at a rear of a wing of an aircraft by a merging of first and second co-rotating eddies,” as recited in independent Claims 1 and 10. Therefore, the Huenecke patent cannot teach “a method for accelerating *a destruction of a vortex* formed at a rear of a wing of an aircraft by *a merging of first and second co-rotating eddies*,” since in Huenecke’s method, one of the eddies that would be “co-rotating” is countered by a third “counter” eddy, thereby not becoming “co-rotating,” and does not, therefore, merge with the first co-rotating eddy to form a vortex as recited in the claims. In other words, a teaching of a method that removes a necessary constituent of a problem, to solve that problem by preventing its actual formation, does not teach, or anticipate, a method that solves the properly formed problem.

Therefore, the prior art fails to teach or suggest every feature recited in Applicant's claims, so that Claims 1-4 and 10-15 are patentably distinct over the prior art. Accordingly, Applicant respectfully traverses, and requests reconsideration of, the rejection based on the Lessen publication.

In response to the rejection of Claims 5 and 16, Applicant respectfully requests reconsideration of the rejection and traverses the rejections as discussed below.

Applicant respectfully submits that the Tangler patent, directed to a blade construction for delayed diffusion of a vortex formed from airflow streaming from a blade tip, does not teach the afore-mentioned features of amended independent Claims 1 and 10 not taught by the Crouch et al. application and the Huenecke patent. Therefore, even if the combination of the Crouch et al. application and Huenecke and Tangler patents is assumed to be proper, the combination fails to teach every element of the claimed invention. Specifically, the combination fails to teach a method for accelerating a destruction of a vortex formed at a rear of a wing of an aircraft by a merging of first and second co-rotating eddies, the method including: generating a periodic perturbation adjacent an area of creation of the first eddy, the

periodic perturbation having a wavelength capable of exciting at least one internal instability mode of the core of the first eddy. Accordingly, Applicant respectfully traverses, and requests reconsideration of, this rejection based on these patents.¹¹

Consequently, in view of the present amendment, no further issues are believed to be outstanding in the present application, and the present application is believed to be in condition for formal Allowance. A Notice of Allowance for Claims 1-31 is earnestly solicited.

Should the Examiner deem that any further action is necessary to place this application in even better form for allowance, the Examiner is encouraged to contact Applicant's undersigned representative at the below listed telephone number.

Respectfully submitted,

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¹¹ See MPEP 2142 stating, as one of the three "basic criteria [that] must be met" in order to establish a *prima facie* case of obviousness, that "the prior art reference (or references when combined) must teach or suggest all the claim limitations," (emphasis added). See also MPEP 2143.03: "All words in a claim must be considered in judging the patentability of that claim against the prior art."